# A Corporate Governance Reform as a Natural Experiment for Incentive Contracts

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First Version: 05.06.2003
This Version: 01.07.2004

ABSTRACT

The present paper proposes to employ a major shift in the legal and institutional environment to identify contractual incentives from the correlation of executive pay and firm performance. We use the reform of the German stock companies act in 1884 as such a major shift and estimate the sensitivity of the pay to firm performance between 1870 and 1910 for executives of nine large banks. The reform substantially enhanced corporate control and strengthened monitoring incentives. Accordingly, we find the pay-performance sensitivity to decrease significantly after the reform. While executives received a bonus of 39 M per 1000 M increase in profits before 1884, after the reform the sensitivity decreased by two-thirds.

*JEL-Classification:* G30, J33, N23

*Keywords:* pay-performance sensitivity, natural experiment, legal reform, corporate governance

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‡We would like to thank Kornelius Kraft, Michael Roos, participants of the Royal Economic Society Meeting 2004, and seminar participants at the University of Dortmund for helpfull comments and suggestions. Christian Bayer would like to thank the Deutsche Forschungsgemeinschaft for financial support. An earlier version of this paper was written while Carsten Burhop was a research fellow at the Center for Development Research, Bonn University. Financial support of this institute is gratefully acknowledged.

## 1 Introduction

Incentives are at the core of economic analysis and a large body of theoretical and empirical work is devoted to the analysis of incentives. Especially working contracts have been intensively investigated (see Prendergast, 1999, for an overview). An underlying assumption of this literature is that individuals respond to contracts that reward performance and contracts are written with this reaction in mind.

The validity of the latter presumption can often only be inferred from statistical relationships, since actual working contracts are most of the time not observable to the econometrician. However, it is not sufficient to find some reduced form correlation to identify the incentive character of contracts. The statistical correlation of pay and performance is composed of ex ante correlation–more able managers have better performance and get paid more–and ex post correlation. But only ex post correlation induces performance and therefore needs to be identified.

We propose to employ a major shift in the legal and institutional environment for identification, using a legal reform as a quasi natural experiment. The institutional setting substantially influences the contracts principals and agents optimally agree upon in three ways. First, it defines the set of enforceable agreements. Second, it sets the rules of corporate control and hence determines the principal's information. And last but not least it restricts the agents set of possible and legal actions.

First empirical studies concentrated on the reduced form relation of pay and performance, especially they focus on the remuneration of top executives of publicly traded companies. For example, Jensen and Murphy (1990) report in their seminal article that compensation of CEOs increases by 3.25$ per 1000$ increase in shareholders' wealth,[1] which has been perceived as overly weak incentives for executives.[2] Yet, many factors shape the contracts, so it is hard to argue what would be a good or optimal pay-

[1] Zhou (2000) analyses Canadian data and Kato (1997) analyses Japanese data. Both report sensitivities that are somewhat larger than what Jensen and Murphy report.

Core et al. (2003) give a review of the recent literature on stock-based executive compensation and incentives. Murphy (1999) gives an excellent and very general review of the literature concerning incentive related pay for managers; John and Qian (2003) review the CEO-compensation literature with special focus on the banking industry. Shleifer and Vishny (1997) give a general survey of the literature on corporate governance.

As we will analyse German data, one may wonder if for modern German data the sensitivity of pay to performance is much different to the one for the US. Indeed, the dependency of managerial salaries on profits is also reported to be rather weak for Germany (See e.g. Schwalbach and Graßhoff, 1997, or Kraft and Niederprüm, 1999a and 1999b). For the period analysed, contemporaries criticised the high salaries of managers and the low dependency of manager-salaries on performance (Warschauer 1902). However, Burhop (2004c) argues on the basis of reduced form regressions that the pay-performce sensitivity in 19th century Germany was considerably large.

[2] Indeed, for the 1990s, Hall and Liebmann (1998) find an increase in the pay-performance sensitivity.

performance sensitivity. These factors are in part unobservable ones such as risk-aversion and the costs and benefits of managerial effort and in part observable ones such as the institutional background and firm-specific risk.

Moreover, reduced form results cannot be directly interpreted in a structural way. For example, Himmelberg and Hubbard (2000) or Grossmann (2003) argue that general-equilibrium effects already induce some correlation between performance and pay even without any strategic considerations when able managers are scarce. Additionally, better qualified managers will work for firms that highly reward performance. Thus, incentive contracts become a selection device and increase performance but do not induce managers to exert more effort (Lazear 1986, 2003). Furthermore, performance pay transfers income risks from firms to managers and firms have to compensate them for these risks. Total remuneration of managers is thus higher in firms with strongly performance related pay. Again this yields an ex ante correlation.

To identify the ex post correlation that induces managers to exert effort large changes in the legal system can be used since this system defines the deep parameters that are embedded in the optimal contracts of managers.[3] From Conyon (1997) and Core et al. (1999) we know that changes in corporate governance have some influence on the *level* of managerial compensation. Yet, changes in corporate governance have—to our knowledge—not been used before as a quasi-natural experiment to identify the incentive character of contracts,[4] probably because large reforms that qualify as such an experiment are naturally rare. However, we have a unique data set that contains accounting data from nine large German banks covering the period from 1871 to 1910; a period in which the stock company act of 1884 falls. This act is arguably one of the most fundamental reforms the German legal system of corporate governance has undergone so far.

The act strictly separated control rights between the supervisory and the executive board of a company and still builds the backbone of the modern German system of corporate governance. As the reform aimed at solving problems of corporate control,

[3] In identifying the incentive character of contracts, especially firm-specific risk has played a central role in a major part of the literature. Theory predicts for incentive contracts that the higher the volatility of returns is, the higher should be the salary-based pay-performance sensitivity. Empirical evidence for this is mixed. Aggarwal and Samwick's (1999) results are supportive for the principal-agent theory, whereas Garen (1994) and Lambert and Larker (1987) do not find strongly significant differences between high-volatility and low-volatility firms.

[4] Recently however, Talley and Johnsen (2004) analyzed the interaction of corporate governance, executive compensation and securities litigation. They provide a detailed model of this interaction and find that corporate governance serves as a substitute for incentive pay, both, empirically end theoretically. The paper of Joskow et al. (1996) analyzes the effects of regulation on incentive pay, too. Yet its focus is rather on political influence on compensation packages than on structural identification.

we can expect moral hazard to be of lesser importance in the period after 1884 and the *sensitivity* of pay to firm performance to decrease substantially after the reform. Indeed, before the reform the sensitivity is estimated as a 39 M increase in pay per 1000M increase in profits. After the reform pay increases only by 14 M per 1000M increase in profit. Hence, at least the difference of 25 M can be identified as an incentive scheme for which the new corporate governance code has been a substitute.

The remainder of this paper is now organized as follows. In section 2, we present some historical background information in which we describe the major legal-institutional shifts of the 1884 legal-reform of the corporate governance code. Section 3 motivates our identification strategy with a stylized model of an incentive contract. Section 4 puts the identification strategy into an econometric perspective. Then section 5 describes our data, and section 6 presents the empirical results. Finally, section 7 concludes.

## 2 Historical background

The years 1870-73, the so-called *Gründerjahre*, were marked by a substantial stock-market activity: more than 900 new stock companies were founded in Germany between summer 1870 and spring 1873, and the stock-market index doubled from August 1870 until December 1872. Driving forces for this "new economy" were the complete de-regulation of stock companies in 1870, the foundation of the German Empire in 1871,[5] and the expansive shock of French reparation payments after the German-French War of 1870-71. The latter shock had an especially strong impact on financial markets and on the market for IPOs, since governments of German states and the North-German federation devoted French payments to repay debt. Supply of government bonds run short in Germany and in a way forced investors into risky assets and especially the market for IPOs grew rapidly.

This strong interest in IPOs made corporate control laxer already, but the 1870 stock companies act even aggravated this. This act replaced stricter laws in most German states, but it especially softened the tight regulation in Prussia, the most important member state of the North-German federation. At the time, Prussia's capital Berlin was the most important financial center in Germany increasing the impact of the new act in 1870 on the financial sector. Before 1870 a royal concession was necessary to found a stock company and state supervision was compulsory in Prussia. In other German states the situation was similar. However, after 1870 the new act effectively liberalized

[5] This had a positive effect on allocation and improved institutions. For example, free movement of goods and factors was introduced and a common currency, the Mark, was established.

the founding and supervision of companies completely.

Now, virtually everybody could found a stock company. When a company was founded, only 10 per cent of the capital had to be paid up (40 per cent in case of stock-market quotation), and the face value of shares was low (only 100 Mark). Consequently, stocks were an investment option also for upper-middle income households, which suggests a low concentration of ownership as a consequence.[6] But not only the issue of low concentration of ownership made monitoring relatively costly for shareholders, also the rights of shareholders and of the supervisory board could be restricted. So-called *Gründerrechte* granted special rights to the founder of a new company, e.g. a fixed profit share for several years.

In addition, the legal rules of corporate governance were weak. The founder of a company could practically appoint the first supervisory board, whose members stayed there for several years. Moreover, the voting rights of shareholders on annual meetings could be restricted and, finally, publication of a profit-loss statement was not compulsory.

The impact of the liberal regulation was even aggravated by weak threats of punishment for misbehavior. Jointly and severally, these legal shortcomings sometimes lead to outright fraud and many companies busted soon.

For example, the Schaaffhausen'sche Bankverein was cofounder and major owner of the Rheinische Effectenbank in Cologne. Although the Bankverein was the oldest stock credit bank in Germany and one of the leading institutes during the 1870s it did not monitor the Effectenbank closely. In consequence, the director of the Effectenbank sold securities with a value of 6 Million Mark owned by customers of the bank. Then he registered this transaction as a gain for the bank, giving him a substantial increase in his bonus payments. Although this was an outright theft, and the responsible director of Rheinische Effectenbank was sentenced, still it was a good deal for him. The maximum penalty in the stock companies act was three months imprisonment or a 3,000 Mark fine (see Burhop 2004a, Chapter 3.3.2; Glagau 1877 for numerous other cases).

This example, and many others, called for the necessity of a reform which was well recognized by contemporaries.[7] Not least the stock market crash of 1873 strengthened

[6] Unfortunately data on ownership structure are unavailable for this time. Even if ownership was concentrated most corporate statutes before 1884 imposed a cap of 10 votes for each person attending the annual meeting of shareholders. After 1884 such statutes became illegal.

[7] For example, the national-liberal Reichstag member and former law professor Tellkampf demanded the complete abolition of joint-stock companies. He argued that limited liability was against the foundation of moral and fairness (Tellkampf 1876). Similarly, the Verein für Socialpolitik, the association of German economist, asked for the restriction of joint-stock companies to certain industrial and economic sectors; especially railways, banking, and insurance should be free of joint-stock companies.

Van der Borgth (1883, pp.17) argued that deficits in corporate control, weak incentives, and a lack of

this demand for a reform. In 1884 a fundamental reform was finally implemented. This reform created many central properties of today's German stock-company law. For the first time, the new law strictly separated the functions of the supervisory and executive boards. Moreover, the minimum face value of shares was increased by ten to 1,000 Mark. The shares had to be paid up in full, raising the effective minimum costs of a quoted share by the factor 25 and all shareholders got participation and voting rights for the annual meeting. In addition, publication of a profit-and-loss statement and an annual balance sheet in the Reichsanzeiger, the official newspaper of German government, became compulsory. Finally, the penalties for misbehavior of supervisory and executive board members were increased. The new law thus increased the monitoring incentives and abilities for shareholders, and it increased the misbehavior costs (and detection risks) for executives. A simultaneously enacted foundation law also removed most of the founder rights (Ring 1890, Hopt 1980).[8]

Although the effectiveness of the 1884-act was questioned by some contemporaries, this discussion focussed rather on possible extensions of the reform, than on the general direction of the reform itself (Warschauer, 1902 and Philippovich, 1909). In general, the reform was perceived as an improvement of corporate control and corporate governance (Hessberger, 1889, p. 57).

Especially the discretionary power of managers declined together with higher costs of misbehavior after 1884 and this can be expected to have a substantial influence on the economic relationship between principals and agents. Therefore, the reform can be used as a quasi-natural experiment in order to test for the incentive character of contracts.

## 3 A simple theoretical model

How the legal reform can have influenced the manager's contracts may be formalized in a *stylized* way in the following costly-state verification model. Suppose a principal has a potentially profitable project (firm) that can only be realized by employing a manager. This manager is risk-averse and enjoys utility from income $x$

$$u(x) = \ln(x). \tag{1}$$

monitoring hampered corporate performance of stock corporations.

[8] About 15 years after the seminal reform of 1884, a new unified German commercial law (Handelsgesetzbuch) was enacted in 1900. Generally, new regulations for stock companies in this 1900 law were of minor importance. However, the reform further increased punishments for misbehavior and extended the list of statutory offences. Additionally, calculation of profits and accounting rules were further standardised. See Gareis (1900) for details.

Her income is composed of her wage $w$ and resources $r \geq 0$ she diverts from the firm's profits $\pi$.

Profits can be high $\pi_h$ or low $\pi_l$ depending on the success of the project, which is assumed to be purely random and equally likely for simplicity. However, only the manager but not the principal can observe $\pi$ without cost. The principal only observes $\pi - r$ which the manager announces as the "true" profit. Yet, the principal can pay some cost $C$ to verify this announcement. When the principal pays the verification cost, $r$ and $\pi$ become commonly observable and if the manager has diverted resources, $r > 0$, the principal can claim punitive damage $D$ from the agent.

To further simplify the analysis assume $C < D$ so that the principal always verifies if she would know for sure that the agent has taken resources. Moreover assume that the agent must at least leave $\pi_l$ to the principal in any state.

Now assume the sequence of actions is as follows:

1. The principal offers the agent a contract $w(\pi) = \begin{cases} w_h & \text{if reported } \pi = \pi_h \\ w_l & \text{if reported } \pi = \pi_l \end{cases}$.
2. The agent observes $\pi$. She redirects resources $r \geq 0$ to private projects and reports and pays the residual to the principal.
3. The principal decides whether to verify the agents action, pays the wage and potentially reclaims damage.

This model can be solved by backward induction.

The principal knows for sure, that the agent has redirected resources, whenever $\pi \neq \pi_{h,l}$. In this case she will always verify. If $\pi = \pi_h$ the principal knows that no resources have been taken and will not verify. If $\pi = \pi_l$ this can either be a result of bad luck and $r = 0$ or because the agent has taken $r = \pi_h - \pi_l$. Suppose, the agent takes $\pi_h - \pi_l$ with probability $\theta$ when in state $\pi_h$. Then, with probability $\frac{\theta}{(1+\theta)}$ the principal observes $\pi_l$ although the true $\pi$ was $\pi_h$. Hence, the principal's benefit from verifying conditional on observing $\pi_l$ is $\frac{\theta}{(1+\theta)}D - C$. So she is indifferent between verifying and not verifying when $\theta = \theta^* = \min\left(\frac{C}{D-C}, 1\right)$. For $\theta < \theta^*$, the principal will never verify and for $\theta > \theta^*$, she will always verify.

As the principal will always verify when the manager takes $r' \neq \pi_h - \pi_l$, the manager is strictly better of taking $r = \pi_h - \pi_l$ if she takes anything. If the manager takes $r$ and the principal verifies with probability $p$, the manager's expected utility is $pu(w_l + r - D) + (1-p)u(w_l + r)$. The payoff from not taking $r$ is $u(w_h)$. Hence, the manager will always

take $r$ if

$$pu\left(w_l + r - D\right) + \left(1 - p\right) u\left(w_l + r\right) > u\left(w_h\right). \tag{2}$$

She will take nothing, if $pu\left(w_l + r - D\right) + \left(1 - p\right) u\left(w_l + r\right) < u\left(w_h\right)$ and is indifferent when

$$pu\left(w_l + r - D\right) + \left(1 - p\right) u\left(w_l + r\right) = u\left(w_h\right). \tag{3}$$

In equilibrium both, the manager and the principal must be indifferent between stealing and not stealing respectively verifying and not verifying. Hence we obtain as equilibrium payoffs

$$E\left(u\right) = \frac{1}{2}\left(u\left(w_l\right) + u\left(w_h\right)\right) \tag{4}$$

$$E\left(\Pi\right) = \frac{1}{2}\left(1 - \theta^*\right)\left(\pi_h - w_h\right) + \frac{1}{2}\left(1 + \theta^*\right)\left(\pi_l - w_l\right) \tag{5}$$

Maximizing $E\left(\Pi\right)$ by choosing $w_{h,l}$ subject to $E\left(u\right) \geq \ln\left(\bar{w}\right)$, where $\bar{w}$ is the outside option wage for the manager, yields the first order conditions

$$-\left(1 - \theta^*\right) = \lambda w_h^{-1} \tag{6}$$

$$-\left(1 + \theta^*\right) = \lambda w_l^{-1} \tag{7}$$

Hence, we obtain for the optimal wage scheme

$$w_h = \frac{1 + \theta^*}{1 - \theta^*} w_l = \frac{D}{D - 2C} w_l. \tag{8}$$

So from that model, we find that the larger the cost of investigation or the smaller the maximum damage that can be reclaimed, the more do salaries diverge between good and bad states. In terms of profit shares, this means, when $C$ is high or $D$ is low, then the profit share the manager obtains is high. As outlined before, the 1884 reform lowered the investigation costs for principals and also increased penalties for agent's misbehavior. Therefore, we can expect the pay-performance sensitivity to decrease after that reform.

Also, one can see that it is in the interest of both, the manager and the principal to agree on a large penalty. However, legal regulations typically define maximum penalties and thus restrict both parties in this pre-commitment. [9]

[9] The interpretation of $r$ as being resources taken from the firm can easily be extende to shirking within the model. Suppose $D$ is an extra payment the manager gets unless he has been shirking when the state has turned out to be good. Then $r$ can be reinterpreted as saved effort by shirking, but the analysis and the optimal contract prevails.

## 4 Identification strategy and empirical model

Building from our theoretical model, the basic regression for an incentive contract would be

$$w_{it} = \alpha_0 + \alpha_i + \beta\pi_{it} + u_{it} \tag{9}$$

in which $w_{it}$ denotes the average bonus payment per executive of bank $i$ at time $t$. The wage depends on the published profit $\pi_{it}$ with the pay-performance sensitivity $\beta$.

However, a simple regression using (9) does not identify incentives for managers, because $\pi_{it}$ and $u_{it}$ may be correlated due to the various reasons outlined in the introduction. Moreover, from our theoretical model, we know that $\beta$ may actually vary with changes in legal institutions. Nevertheless, at least the effect a change in the institution has on $\beta$ can be identified using the difference between two estimates of $\beta$ from two periods in which legal institutions stay constant. Consider two sub-periods, period 0 and 1, for which $\beta$ differs. For each period $j$ the simple OLS estimator $\hat{\beta}_j$ asymptotically converges to $\hat{\beta}_j = \beta_j + \frac{cov(\pi_{it}, u_{it}+\alpha_i)}{var(\pi_{it})}$. Therefore, the difference $\hat{\beta}_0 - \hat{\beta}_1$ is asymptotically unbiased if $\frac{cov(\pi_{it}, u_{it}+\alpha_i)}{var(\pi_{it})}$ is constant for both sub-periods. This allows to unbiasedly estimate $\beta_0 - \beta_1$ as a lower bound for the incentive based pay-performance sensitivity, since we can expect $\beta_j \geq 0$ from theory.

Hence, our basic estimation equation is

$$w_{it} = \alpha_0 + \alpha_i + \beta_0\pi_{it} + (\beta_1 - \beta_0)\,\pi_{it}\mathbb{I}_{t\geq 1885} + \gamma x_{it} + u_{it}. \tag{10}$$

In this equation $\mathbb{I}_{t\geq 1885}$ denotes an indicator function that takes the value 1 after the reform in 1884 and zero otherwise. The vector $x_{it}$ represents other covariates that could influence bonus payments, e.g. stock-prices, the NNP, and the general stock-market index.

## 5 Data Description

Our main data source is Bosenick (1912), who gives detailed information on nine large German joint-stock credit banks for the years 1871 to 1910. These banks are Schaaffhausen'scher Bankverein, Bank für Handel und Industrie, Disconto-Gesellschaft, Berliner Handels-Gesellschaft, Mitteldeutsche Creditbank, Deutsche Bank, Commerz- und Discontobank, Dresdner Bank, and Nationalbank für Deutschland. In 1910, the last year for which data are reported, these banks had total assets of nearly 7.9 billion Mark and they represented a market share of about 52 per cent of all joint-stock credit banks in Germany.

Table 1: Summary statistics

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Stock-Price (in %) | 320 | 116.5 | 33.15 | 45.37 | 256.4 |
| Dividends (1000M) | 320 | 4664 | 4329 | 0.00 | 24325 |
| Profit (1000M) | 320 | 5998 | 5785 | -3118 | 31671 |
| Bonus-Payments (1000M) | 320 | 720.0 | 794.6 | 0.00 | 4804 |

Bosenick reports total assets, asset and liability structure, profits, dividends, share price, and share in the profits paid to executive and supervisory board members. Since Disconto-Gesellschaft and Schaaffhausen'scher Bankverein did not publish profit-loss statements until 1885, Bosenick (1912) did not include these data. The missing information was complemented from archival records (see Burhop 2004a, Chapter 2 for details). Data for the "Dresdner Bank" are available from 1873 onwards, and for the "Nationalbank für Deutschland" from 1881 onwards, since these two banks were only founded in the corresponding years.

For all banks, the executives are known in each year by name from Reitmayer (1999). Hence, the size of executive board can be calculated. The size of this board varies over time and between banks. Because of this, we normalize the total bonus paid to executives by their number to obtain the average bonus.

Table 1 gives a summary statistics of the data deflated to 1913 prices for comparison. Table 2 presents some data for single banks. Firm performance of banks varies over the four decades under consideration. In 1871, Disconto-Gesellschaft, Bank für Handel und Industrie, and Schaaffhausen were the largest joint-stock credit banks in Germany. Forty years later, a different picture emerges: now, Deutsche Bank, Dresdner Bank, and Disconto-Gesellschaft are market leaders.

Average dividend yield varies only mildly between 4.7 per cent (Berliner Handels-Gesellschaft) and 5.4 per cent (Deutsche Bank and Bank für Handel und Industrie). Yet, total stock market return (average dividend yield and average increase of stock market value) distinctively differs from 5.8 per cent (Mitteldeutsche Creditbank) to 14.6 per cent (Dresdner Bank) and 14 per cent (Deutsche Bank).

Finally, total profit shares for boards widely differed. Averaging over all banks and four decades, about 10.3 per cent of accounting profits were paid out as bonus to executive and supervisory board members. The bonuses paid to the boards of Dresdner Bank and Disconto-Gesellschaft amounted to 15.3% and 14.8% of all profits respectively, while Commerz- and Discontobank and Mitteldeutsche Creditbank only paid 5% and 5.4% of their profits to their board members, see table 2.

Table 2: Descriptive statistics for single banks

| Name | Total assets in million Mark (1913 prices) | Total assets in million Mark (1913 prices) | Stock market value in million Mark (1913 prices) | Stock market value in million Mark (1913 prices) | Average dividend yield | Average bonus in percent of accounting profit |
|---|---|---|---|---|---|---|
| | 1871 | 1910 | 1871 | 1910 | 1871-1910 | 1871-1910 |
| Schaaffhausen'scher Bankverein | 117 | 696 | 61 | 213 | 4.9% | 6.2% |
| Bank für Handel und Industrie | 141 | 906 | 97 | 207 | 5.4% | 10.9% |
| Disconto Gesellschaft | 189 | 1,161 | 112 | 338 | 5.1% | 14.8% |
| Berliner Handels-Gesellschaft | 84 | 554 | 42 | 192 | 4.7% | 12.4% |
| Mitteldeutsche Creditbank | 102 | 227 | 48 | 68 | 4.9% | 5.4% |
| Deutsche Bank | 44 | 2,218 | 22 | 542 | 5.4% | 11.2% |
| Commerz- und Discontobank | 27 | 454 | 14 | 100 | 4.9% | 5.0% |
| Dresdner Bank | 19 | 1,418 | 11 | 334 | 5.3% | 15.3% |
| Nationalbank für Deutschland | 41 | 447 | 27 | 107 | 5.0% | 11.8% |

A shortcoming of our data is that it does not include two possibly relevant parts of the incentive package. First, we do not have information about the fixed salary of bank managers. Second, share ownership might motivate managers, but again data on shareholdings of managers is not available.

Although the fixed salary of bank executives indeed changed during 1871 to 1913 (Burhop, 2004b) and increased from 12,000 Mark on average during 1871-84, to around 31,000 Mark in 1885-1913 (both in 1913 prices), performance pay still accounted for 70 per cent of total compensation even in the latter period.

The other unobserved part of the incentive package, shareholdings, might have indeed played a role in motivating managers. In fact, most working contracts of executives and company statutes stipulated shareholding for executive- and supervisory-board members. However, compared to the average income of executives, this compulsory shareholding was of minor importance. Moreover, there is no evidence for a change in compulsory

Table 3: Significance of a unit-root, Maddala-Wu (1999) Fisher-Test

| Variable | With Trend | No. of individual rejections at 10% |
|---|---|---|
| Profit | 0% | 5 |
| Bonus (sum of all executives) | 0.01% | 2 |
| Bonus (per executive) | 0% | 6 |
| Stock-Price | 0% | 7 |

shareholding after 1884.[10]

In addition to these two unobserved direct incentives for managers, monitoring activities of shareholders might vary between banks, for example if shareholding of some banks was dominated by block-holders. Yet, the general ownership structures of stock companies are unknown for the German Empire. For modern Germany, Schmid (1997) shows that the influence of the ownership structure on executive compensation is rather weak. Furthermore, any influence of the 1884 reform on ownership structure which influences incentive contracts can be understood as a substitute for pecuniary incentives and hence will not bias our identification strategy, but rather bolster it (see section 4).

A further complication could result from the dynamic structure of our data. Especially profits typically show substantial serial correlation. Table 3 shows the results of a Maddala-Wu (1999) Fisher tests for unit-roots for the relevant variables.[11] We can reject the hypothesis of a common unit-root for all relevant variables (profits, bonuses and stock prices) on all usual levels of significance. As the banking sector could be expected to grow for the time-period we analyze, we allow for a trend.

## 6 Estimation results

### 6.1 Basic model

Our basic estimation model is

$$w_{it} = \alpha_0 + \alpha_i + \beta_0 \pi_{it} + (\beta_1 - \beta_0)\, \pi_{it} \mathbb{I}_{t \geq 1885} + \gamma x_{it} + \delta \mathbb{I}_{t \geq 1885} + u_{it}. \tag{11}$$

Hence, we regress the bonus payment per member of the board of executives of a firm on profits and a vector of covariates $x_{it}$. This vector consists of the price of shares (in %

[10] Of course managers might have held more than the compulsory number of shares, but data on that is unavailable. However, the influence of shareholding will only bias our identification scheme if managerial shareholding changed after 1884.

[11] The test bases on an ADF-Statistics for each individual bank, allowing for variable lag-length, which has been determined using a LM-Test.

of nominal equity) as an idiosyncratic component, and the stock market index, the real interest-rate, and the real NNP to control for aggregate shocks.

We estimate the equation using an OLS (with a common intercept), a fixed effects, and a random effects estimator. The results are reported in Table 4. The point estimates do not differ substantially between all three estimators. Hence, a Hausman test does not reject the random effects model.

We estimate our central parameters $\beta_0$ and $(\beta_1 - \beta_0)$ as 0.0387 and -0.0248 respectively. This means, that before the reform the bonus of a board member increased by 39 M per 1000M increase in profits. After the reform the typical executive-board member's income only increases by 14 M for the same increase in profits, so that the decrease in the pay performance sensitivity amounts to 2.5 percentage points. In turn, these 2.5% give a lower bound for the incentive component in pay before the reform.

The point estimates can also be used to calculate the average incentive package both, before and after the reform. The average profit after 1884 is 8.640.000 M per bank, before the reform the average profit is 3.657.000 M (in current prices). Therefore, the increase in profits party offsets the decreasing sensitivity in its impact on bonus payments. So that on average the compensation from direct incentives only decreased from about 142.000 M ($\beta_0 \pi_{it}$) per manager before the reform to 120.000 M ($\beta_1 \pi_{it}$) after the reform. However, total bonus payments per executive increased after the reform, since the bonus payment that does not depend on performance increased by about 78.000 M ($\delta$) on average.

The only covariate that is weakly significant is the real-interest rate. The estimated coefficient is negative which may be interpreted as a sign for relative performance evaluation. Economically however, the influence on the real interest rate on bonuses is minor and the standardized coefficient is 20 times smaller than the coefficient on profits.

### 6.2 Extensions

Yet, our basic approach may be overly simplistic both economically and econometrically and as a result the estimates could be biased. We assumed the contracts to be homogeneous both, across executives and across banks. Hence, heterogeneity in the types of contracts the banks offer could be a problem. On the side of the econometrics, censoring could bias results, since bonuses never get negative. Moreover, the dynamic structure of the data has been omitted. However, the following discussion shows that our results are very robust to all these complications. For all extensions we drop the insignificant aggregate factors from the list of regressors, i.e. we only keep the share price and the real interest rate as covariates.

Table 4: Basic regression results

| | Random Effects | | | Fixed Effects | | | OLS | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | | S. E. | Coefficient. | | S. E. | Coefficient. | | S. E. |
| Profit | 0.039 | *** | 0.003 | 0.039 | *** | 0.003 | 0.039 | *** | 0.003 |
| Profit*post-1884 | -0.025 | *** | 0.002 | -0.025 | *** | 0.002 | -0.025 | *** | 0.003 |
| Share price | -0.225 | | 0.246 | -0.267 | | 0.248 | 0.242 | | 0.262 |
| Stock market index | 0.101 | | 0.305 | 0.128 | | 0.305 | -0.182 | | 0.360 |
| NNP | 0.000 | | 0.001 | 0.000 | | 0.001 | 0.001 | | 0.001 |
| Real interest rate | -3.855 | + | 2.208 | -3.913 | + | 2.202 | -3.388 | | 2.66 |
| Post-1884 | 77.95 | *** | 17.46 | 77.717 | *** | 17.41 | 80.87 | *** | 20.98 |
| constant | -22.35 | | 47.39 | -21.91 | | 43.68 | -67.56 | | 51.36 |
| $R^2$ (overall) | 0.632 | | | 0.631 | | | 0.637 | | |
| Wald-test | 559.53 | *** | F-test | 78.03 | *** | | 84.86 | *** | |
| Hausman test | 1.45 | | | | | | | | |

*** / + denote significance at the 0.1% and at the 10% level respectively

### 6.2.1 Effects of tenure and trend in bonuses

So far, we have not used any information about the individual members of the executive boards of the nine banks in our sample. However, reputation—amongst other individual factors—may play a substantial role in the compensation scheme. Moreover, stock companies as banks were relatively new at the time analyzed and hence, when our sample starts managers may not have acquired as much reputation or knowledge as they might have for the period after 1884. Therefore, one may argue that our regression simply picks up this difference that serves as a substitute for direct incentives, so that our "reform effect" would be in fact the effect of reputation and learning.

Hence, we try to proxy for this by adding in the average number of years $num\_year_{it}$ the executives have been on the board of bank $i$ up to year $t$. Moreover, we interact this term with profits to see whether managers with a longer history within that bank get rewarded differently from more junior colleagues. Additionally we add a linear time trend to control for general industry growth and fiercer competition for managers.

$$w_{it} = \alpha_0 + \alpha_i + \beta_0 \pi_{it} + (\beta_1 - \beta_0)\, \pi_{it} \mathbb{I}_{t \geq 1885} + \beta_2 num\_year_{it} \cdot \pi_{it} + \gamma x_{it} + \delta_0 \mathbb{I}_{t \geq 1885} + \delta_1 num\_year_{it} + \delta_2 t + u_{it}. \quad (12)$$

Table 5 reports the estimation results for the modified specification (12), again using fixed effects and random effects estimators.

Only in the fixed effects regression, the linear trend is weakly significant. Because of

Table 5: Estimates including tenure and a trend

| | Fixed Effects | | | Random Effects[a] | | |
|---|---|---|---|---|---|---|
| | Coefficient | | S. E. | Coefficient | | S. E. |
| Profit | 0.040 | *** | 0.003 | 0.035 | *** | 0.003 |
| Profit*Post-1884 | -0.026 | *** | 0.003 | -0.031 | *** | 0.004 |
| Profit*average tenure | 0.000 | | 0.000 | 0.001 | ** | 0.000 |
| Share Price | -0.387 | + | 0.217 | 0.066 | | 0.240 |
| Real interest rate | -5.024 | ** | 1.601 | -3.746 | * | 1.907 |
| post 1884 | 74.373 | *** | 20.392 | 96.812 | *** | 25.001 |
| trend | -2.402 | * | 0.966 | -0.218 | | 1.037 |
| average tenure | 6.978 | ** | 2.438 | -0.029 | | 2.716 |
| constant | -13.343 | | 28.375 | -48.800 | | 31.330 |
| $R^2$ (overall) | 0.6458 | | | $R^2$ (overall) | | 0.6571 |
| F(8,329) | 80.05 | *** | | $\chi^2(8)$ | | 645.91*** |

***/**/*/+ denote significance at 0.1%, 1%, 5% and 10% respectively

[a] The random effects model collapses to OLS

this and since a deterministic trend also has no clear economic interpretation, we do not include a trend in any further specification.

The influence of tenure is only weakly significant, too. Tenure effects may influence the slope and the average compensation, but the reform effect remains relatively unchanged by including tenure and trend. If the inclusion of a trend and tenure has an influence on the estimated reform effect, then they do not decrease the estimate of the reform effect.

The direct influence of tenure on the pay performance sensitivity is positive. This means, managers who are longer with the firm get more monetary incentives. A possible explanation could be Holmstrom (1999) career concerns model. Alternatively, in view of our model, it could be that managers learn to shield themselves from detection of misbehavior over time which results in larger control costs.

### 6.2.2 Bank-specific contracts

However, not only the managers differ with respect to their reaction to incentives, but also banks do differ in their corporate governance. Some banks for example might be owned by large block-holders while others have a widespread ownership. Moreover, two banks in our sample ("Disconto Gesellschaft" and "Berliner Handels Gesellschaft") have at least one fully liable general partner, who also manages (these banks are "Kommanditgesellschaften auf Aktien", KGaA). These differences between banks may result in

different pay-performance sensitivities among banks and hence may bias our estimated reform effect, when low sensitivity banks have become more important over time.

Therefore, we modify our estimation equation and include bank-specific slopes $\theta_i$ of the bonus with respect to profits

$$w_{it} = \alpha_0 + \alpha_i + \theta_i \pi_{it} + (\beta_1 - \beta_0)\, \pi_{it} \mathbb{I}_{t \geq 1885} + \beta_2 num\_year_{it} \cdot \pi_{it} + \gamma x_{it} + \delta_0 \mathbb{I}_{t \geq 1885} + \delta_1 num\_year_{it} + \delta_2 t + u_{it}. \quad (13)$$

Table 6 reports the results for this regression.[12] A Hausman Test rejects the random effects model, which in fact is equivalent to the simple OLS.

The "Schaaffhausen'sche Bankverein" (SBV) has been used as reference bank. Compared with this reference, we find a significant and substantial difference in the pay performance sensitivity for some banks. Yet, we do not see any very clear-cut structure in these differences. "Disconto Gesellschaft", "Berliner Handels Gesellschaft" (BHG), "Dresdner Bank", and "Nationalbank" have an incentive scheme that rewards performance more strongly, while the other banks reward similar to SBV. Disconto Bank and BHG both have at least one fully liable managing partner, and more performance rewarding contracts may be a way to expropriate minority holders. The same argument may hold true for the Dresdner Bank. There the CEO was also a large shareholder, at least in 1873 when the Bank was founded. He stayed in his position for an extraordinary long time until he left the board in 1919.

For the Nationalbank the case may be different. It was founded in 1881 but very badly managed in the first years and was in a deep crisis in 1883 and 1884. Thereafter the management was exchanged completely. Therefore, the Nationalbank may had to attract very able managers by strong incentives to get out of crisis.

However, the parameter of most interest, $(\beta_1 - \beta_0)$, does not change substantially compared to the homogeneous setting. Hence, the estimated effect seems to be robust against the first two extensions of our empirical model. Since both, tenure and firm-specific slopes are empirical significant elements we keep them as part of the model for the econometric extensions we discuss below.

[12] The bank-specific slopes introduce an incidental parameter problem. Hence, $\theta_i$ can only be estimated when $t \to \infty$. Indeed, our panel is long in the time dimension. So this problem is only of minor importance.

Table 6: Estimates including bank-specific slopes

| | Fixed Effects | | | Random Effects[a] | | |
|---|---|---|---|---|---|---|
| | Coefficient | | S. E. | Coefficient | | Std. E. |
| Profit | 0.031 | *** | 0.003 | 0.030 | *** | 0.002 |
| Profit*Post 1884 | -0.022 | *** | 0.002 | -0.023 | *** | 0.002 |
| BHI*Profit | -0.005 | | 0.004 | -0.003 | | 0.002 |
| Disconto*Profit | 0.010 | *** | 0.003 | 0.010 | *** | 0.002 |
| BHG*Profit | 0.015 | *** | 0.003 | 0.017 | *** | 0.002 |
| MCB*Profit | -0.020 | * | 0.008 | -0.012 | ** | 0.004 |
| DB*Profit | -0.003 | | 0.002 | 0.000 | | 0.002 |
| Commerz*Profit | -0.008 | | 0.006 | -0.004 | | 0.004 |
| Dresdner*Profit | 0.014 | *** | 0.003 | 0.014 | *** | 0.002 |
| National*Profit | 0.051 | *** | 0.005 | 0.036 | *** | 0.003 |
| Average tenure*Profit | 0.000 | | 0.000 | 0.000 | | 0.000 |
| Share Price | 0.159 | | 0.181 | 0.106 | | 0.160 |
| Real interest rate | -2.168 | | 1.359 | -2.900 | * | 1.338 |
| Post 1884 | 49.450 | ** | 16.149 | 37.892 | * | 15.413 |
| Average tenure | 2.808 | | 1.836 | 4.202 | * | 1.737 |
| constant | -71.166 | ** | 24.268 | -67.594 | ** | 21.136 |
| $R^2$ (overall) | 0.8399 | | | $R^2$ (overall) | 0.8645 | |
| F(15,322) | 86.730 | *** | | Wald$\chi^2$(15) | 2105.98*** | |
| Hausman Test | 26.370 | ** | | | | |

***/**/* denote significance at 0.1%, 1%, and at 5% respectively

[a] The random effects model collapses to OLS

### 6.2.3 Controlling for censored data

Besides the additional economic factors, our results could be driven by the fact that bonuses are bounded by zero, i.e. by censoring. This problem may lead to mis- and differently measured pay-performance sensitivities before and after the reform. Hence, we employ a random effects Panel-Tobit estimator (see e.g. Hsiao, 2003 for details). Table 7 gives the results.

Again, we see no qualitative difference to the previously estimated models, especially there is no drop in the estimate of $(\beta_1 - \beta_0)$. On the contrary the point estimate becomes even somewhat larger. From the Tobit model the typical contract before the reform would promise a 43 M (34 M) increase in pay per 1000M profit, but only 9 M (8 M) after the reform.

Interestingly, in the Tobit-model with heterogeneous slopes, there is no more additional bank-specific effect on pay. Hence, the Panel-Tobit collapses to a pooled Tobit model.

Table 7: Estimates from Tobit regression, censored at bonus = 0

| | Panel tobit, homogeneous slopes | | | Panel tobit, heterogeneous slopes[a] | | |
|---|---|---|---|---|---|---|
| | Coef. | | S. E. | Coef. | | S. E. |
| Profit | 0.043 | *** | 0.003 | 0.034 | *** | 0.002 |
| Profit*Post-1884 | -0.034 | *** | 0.003 | -0.026 | *** | 0.002 |
| BHI*Profit | | | | -0.003 | | 0.002 |
| Disconto*Profit | | | | 0.008 | *** | 0.002 |
| BHG*Profit | | | | 0.016 | *** | 0.002 |
| MCB*Profit | | | | -0.010 | * | 0.004 |
| DB*Profit | | | | -0.001 | | 0.002 |
| Commerz*Profit | | | | -0.002 | | 0.004 |
| Dresdner*Profit | | | | 0.013 | *** | 0.002 |
| National*Profit | | | | 0.036 | *** | 0.003 |
| Profit*average tenure | 0.000 | | 0.000 | 0.000 | | 0.000 |
| Share Price | -0.089 | | 0.188 | 0.359 | | 0.167 |
| Real interest rate | -6.998 | *** | 1.548 | -3.293 | * | 1.379 |
| post 1884 | 98.431 | *** | 18.920 | 60.552 | *** | 16.084 |
| average tenure | 5.921 | | 2.121 | 4.503 | * | 1.778 |
| constant | -85.725 | ** | 25.125 | -130.526 | *** | 23.032 |
| Log likelihood | -1817.03 | | | | -1734.25 | |
| Wald $\chi^2(7)$ | 1087.68 | *** | | Wald $\chi^2(15)$ | 2182.98*** | |

***/**/* denote significance at 0.1%, 1%, and at 5% respectively

[a] The model with heterogeneous slopes collapses to the pooled tobit

### 6.2.4 Dynamic models

The last possible econometric complication we want to discuss stems from the dynamic structure of the data. Therefore, we allow for possible serial correlation in the error-term. However, this comes at the cost of ignoring the censoring problem. The medium size of our sample does not allow to use a CLAD estimation technique that controls for both censoring and serial correlation at the same time. Instead, we employ a Baltagi and Wu (1999) GLS estimator (both fixed and random effects) and an Arrelano and Bond (1991) GMM estimator. Estimates are reported in Table 8. Qualitatively the results again do not differ much across all three specifications and also do not differ very much to the previous results, but in all dynamic specifications the pay-performance sensitivity decreases somewhat less after the 1884 reform . The decrease is strongest in the random effects specification, yet a Hausman test rejects the random effects model. Both GLS estimators assume an AR(1) error, while the GMM estimation is based on the assumption of autocorrelation in bonuses (so that the error is an MA process). The

Table 8: Estimates from Dynamic Models

| | Fixed Effects | | | Random Effects | | | GMM (Arellano/ Bond) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coef. | | S.E. | Coef. | | S.E. | Coef. | | S. E. |
| Profit | 0.022 | *** | 0.005 | 0.025 | *** | 0.004 | 0.025 | *** | 0.002 |
| Profit*Post-1884 | -0.015 | *** | 0.003 | -0.018 | *** | 0.003 | -0.017 | *** | 0.002 |
| BHI*Profit | -0.004 | | 0.005 | -0.004 | | 0.004 | | | |
| Disconto*Profit | 0.024 | *** | 0.004 | 0.019 | *** | 0.004 | | | |
| BHG*Profit | 0.012 | * | 0.006 | 0.015 | ** | 0.005 | | | |
| MCB*Profit | -0.019 | + | 0.011 | -0.014 | | 0.009 | | | |
| DB*Profit | -0.005 | | 0.005 | -0.002 | | 0.004 | | | |
| Commerz*Profit | -0.002 | | 0.009 | -0.002 | | 0.008 | | | |
| Dresdner*Profit | 0.016 | ** | 0.005 | 0.016 | *** | 0.004 | | | |
| National*Profit | 0.062 | *** | 0.008 | 0.052 | *** | 0.006 | | | |
| Profit*av. tenure | 0.000 | | 0.000 | 0.000 | | 0.000 | 0.000 | | 0.000 |
| Share Price | 0.318 | * | 0.157 | 0.264 | + | 0.156 | 0.091 | | 0.161 |
| Real interest rate | -0.800 | | 0.881 | -0.967 | | 0.890 | -3.198 | ** | 1.169 |
| post 1884 | 48.484 | * | 19.330 | 49.208 | * | 19.156 | 43.511 | ** | 14.249 |
| average tenure | 3.488 | | 2.392 | 2.253 | | 2.211 | 4.045 | * | 1.719 |
| constant | -116.921 | *** | 6.827 | -93.537 | *** | 26.831 | -1.697 | * | 0.686 |
| Bonus (t-1) | | | | | | | 0.456 | *** | 0.032 |
| Autocorrelation | 0.768 | | | Autocorrelation | 0.768 | | | | |
| $R^2$ (overall) | 0.754 | | | $R^2$ (overall) | 0.822 | | | | |
| F(15,313) | 58.480 | *** | | Wald $\chi^2(16)$ | 922.450*** | | Wald $\chi^2(8)$ | | 1207*** |
| Hausman Test | 27.9 | * | | | | | Sargan-J $\chi^2(740)$ | | 472.40 |

***/**/* denote significance at 0.1%, 1%, and at 5% respectively

[a] The model with heterogeneous slopes collapses to the pooled tobit

estimated autocorrelation in the error is with 0.768 quite substantial.

## 7 Conclusion

In this paper, we have used a fundamental reform of the corporate governance code—the 1884 stock company act in Germany—to test for incentive contracts. We find the pre-reform pay-performance sensitivity to be statistically significant and economically important. However, the reform decreased this sensitivity substantially (by about 2/3). In turn, this allows to attribute a substantial fraction of the pre-1884 sensitivity to incentives. As for the post-reform period, naturally we can not exactly differentiate between general-equilibrium and incentive effects in the empirical pay performance sensitivity. Yet, the large impact the reform itself has points towards a substantial incentive proportion in the sensitivity found, as the reform can not be expected to have wiped out

all problems of corporate control but only a substantial fraction.

Our results may also be interpreted in another direction: Given the low pay-performance sensitivity typically found in studies that use modern data, that is data from a well established system of corporate governance, our results may raise a concern whether the focus on motivation to exert effort is the right one. The large impact of a legal regulation for *corporate control* may indicate that not inducing managers to exert effort seems to be the major problem for the principal, but rather directing this effort to profitable activities is the main point of concern.

With this interpretation of our results in mind, an increases in the pay-performance sensitivity is not necessarily an improvement for the shareholders. Such increase might well reflect a worsening of institutions of corporate governance.

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